Shipshewana Lake Aquatic Vegetation Management Plan 2007 Update

Lagrange County, Indiana

http://129.79.145.7/arcims/statewide%5Fmxd/viewer.htm

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Executive Summary

On May 3, 2007 Shipshewana Lake was treated for control of Eurasian watermilfoil (EWM) with an herbicide called Sonar at a rate of 6 parts per billion. The Shipshewana Community Lake Improvement Association privately funded the addition of 2 parts per billion of Sonar to prevent coontail (a native species) from increasing dramatically in 2007 once the Eurasian watermilfoil was removed.

Two aquatic vegetation surveys were conducted during 2007 to monitor changes in the plant community as a result of this treatment. The first survey was conducted prior to treatment on May 3, 2007, and the second was conducted on August 17, 2007. The August vegetation survey found that Eurasian watermilfoil had been reduced to the point that it was undetectable in Shipshewana Lake. The coontail population was reduced from a site frequency of 73.3% on May 3 to 36.7% on August 17, 2007.

Dissolved oxygen readings taken during the August vegetation survey showed that oxygen levels were adequate to support fish life, and no fish kills or negative impacts to the fish population were observed in 2007. Planktonic algae was very prevalent throughout the lake in summer of 2007 as has been the case in years past.

As outlined in the 2006 management plan, poor water quality will likely prevent many native plants from colonizing areas previously infested by Eurasian watermilfoil. Coontail a native plant which does very well in nutrient rich water will likely continue to be the most dominant plant in Shipshewana Lake.

No herbicide treatments for native species will be allowed on Shipshewana Lake in 2008. This will give native plants a chance to re-establish themselves. Spot treatments will take place for any areas of Eurasian watermilfoil re-growth. The two major herbicides used in spot treatments for Eurasian watermilfoil are 2, 4-D and Renovate. 2, 4-D is recommended for use in Shipshewana Lake. It is very similar in chemistry to Renovate and provides very similar results. It is also much less expensive than Renovate.

Based on results from other whole lake Sonar treatments, only minimal re-growth of Eurasian watermilfoil is expected in 2008. Funding should be set aside to treat these areas. In keeping with the three year plan for Shipshewana Lake, $1,875 dollars should be set aside in 2008 to treat up to 5 acres of Eurasian watermilfoil re-growth. Up to $4,000 dollars should also be set aside for survey and planning costs. Cost estimates are included on the following page.

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Shipshewana Lake Treatment Cost Estimates

Project	2007	2008	2009	3 Year Cost Totals
Whole Lake Fluridone Treatment - 6ppb				
Total Estimated Costs	$ 26,300	$0	$0	**$ 33,250**
LARE share – subject to availability	$ 23,670			**$ 27,045**
Association's Share	$ 2,630			**$ 6,205**
Additional 2 ppb to Control Coontail Additional Cost to Association (Not Eligible for LARE Funding)	$3,200			
Follow Up Spot Treatments using 2, 4-D		Up to 5 acres if needed		
Total Estimated Costs	$0	$ 1,875	$ 1,875	
LARE Share – subject to availability		$1687.50	$1687.50	
Association's Share		$187.50	$187.50	

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1.0 Introduction

The first aquatic vegetation survey conducted by Aquatic Weed Control on Shipshewana Lake took place on May 17, 2007. In summer of 2006, approximately 15 acres of Shipshewana Lake were treated with 2, 4-D to try to alleviate severe matting of Eurasian watermilfoil and coontail in the south end of Shipshewana Lake.   In 2006, Shipshewana Lake did not have a completed vegetation management plan, and no funding was available for a whole lake treatment. Based on 2006 survey results, a whole lake Sonar treatment was proposed by Aquatic Weed Control and accepted by IDNR biologists. On May 3, 2007, the entire lake was treated with Sonar to control Eurasian watermilfoil (EWM) and reduce the coontail population. After the Sonar treatment, Eurasian watermilfoil was not found in the late season plant survey of 2007. In 2008, no herbicide treatments will be conducted for native species on the main lake, giving native plants a chance to re-colonize areas of previous EWM infestation. The following chart summarizes all LARE funded activities on Shipshewana Lake.

Table 1: Shipshewana Lake LARE History

Year	Action	Date	Funding Source
2006	Spring and Late Season Aquatic Vegetation Surveys 15 acres treated for EWM with 2, 4-D Management Plan Development	Spring Survey May 17, 2006 July 12, 2006 Late Season Survey August 2, 2006	Lake and River Enhancement Shipshewana Community Lake Improvement Association
2007	Whole Lake Sonar Treatment Aquatic Vegetation Surveys and Management Plan Update	Spring Survey May 3, 2007 Sonar Treatment Mary 3, 2007 Late Season Survey August 17, 2007	Lake and River Enhancement Shipshewana Community Lake Improvement Association

Table 2 is provided for reference regarding plant names commonly used in this document.

Table 2: Scientific and Common Plant Names

Scientific Name	Common Name
Myriophyllum spicatum	Eurasian Watermilfoil
Ceratophyllym demersum	Coontail
Potamogeton pectinatus	Sago Pondweed
Potamogeton foliosus	Leafy Pondweed

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2.0 Watershed and Lake Characteristics Update

Shipshewana Lake is located in western Lagrange County, near the town of Shipshewana, Indiana. It has 202 surface acres with a maximum depth of 14 feet and an average depth of 7 feet (Tyllia, 2000). Cotton Lake Ditch is the lake's major inlet entering from the south (Koza, 2002). The lakes outlet is Page Ditch which exits the lake along the east shore and flows into Taylor Lake and the Pigeon River.

Shipshewana Lake has had a history of poor water quality and high levels of nutrient loading. In 1983, a request was submitted to the Indiana Department of Environmental Management to evaluate the Shipshewana Lake watershed (Koza, 2002). International Science and Technology conducted a feasibility study to improve water quality at Shipshewana Lake. This study recommended that dredging should take place to remove excess sediment from the lake. The dredging project was conducted in 1999 and removed approximately 227, 500 cubic yards of sediment from Shipshewana Lake. However, the project was never completely finished due to a lack of funding. Total costs for the project was around $2.4 million (Koza, 2002).

Dissolved readings were taken by Aquatic Weed Control on August 17, 2007. The results of these readings are outlined in Figure 1.

Figure 1: Shipshewana Lake Dissolved Oxygen Profile
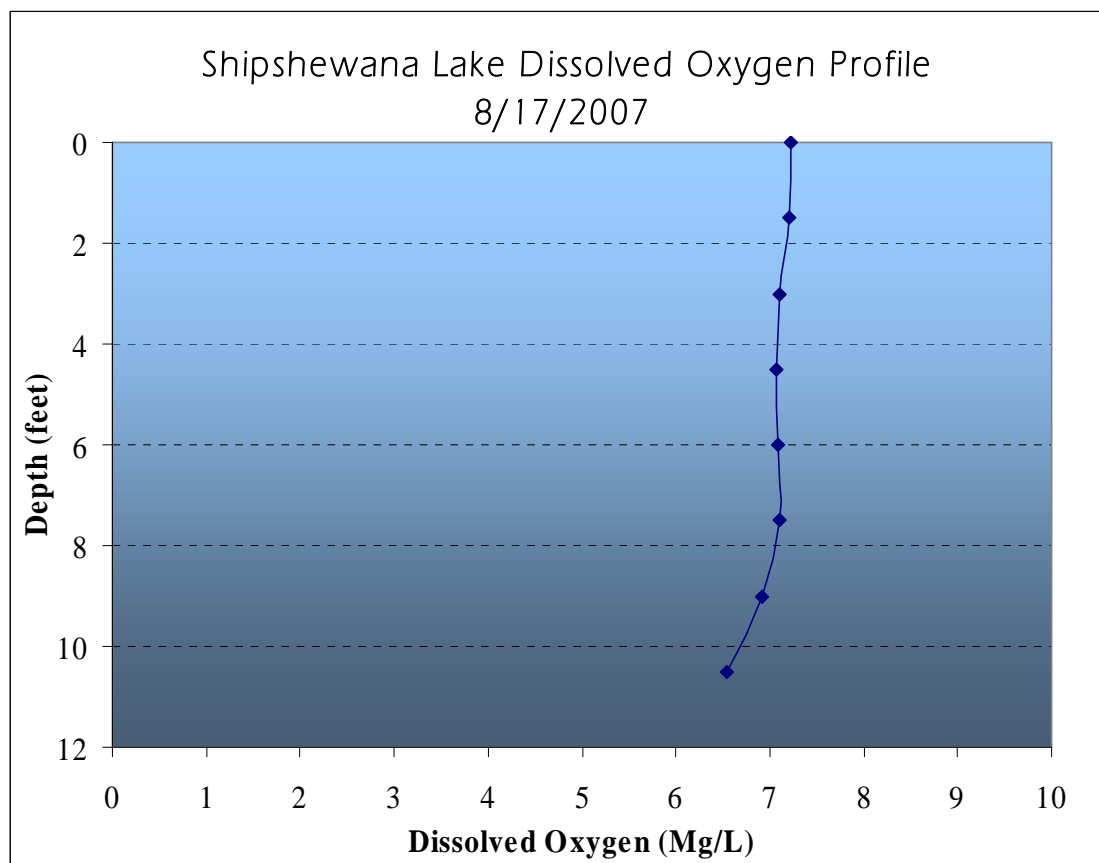
Dissolved oxygen requirements to maintain healthy fish populations of warm-water species are at least 2-5 mg of oxygen per liter of water, while cold-water fish species require 5-9 mg of oxygen per liter of water (Kalff, 2002, p237).

The metalimnion is the transition zone between the surface water and the deep water. It is usually accompanied by rapid changes in dissolved oxygen and temperature. Shipshewana showed no stratification, as no rapid loss of dissolved oxygen was observed. On August 17, 2007, Shipshewana Lake had adequate oxygen to support fish life down to at least 11 feet.

Figure 2 shows temperature readings for Shipshewana Lake.

Figure 2: Shipshewana Lake Temperature Profile
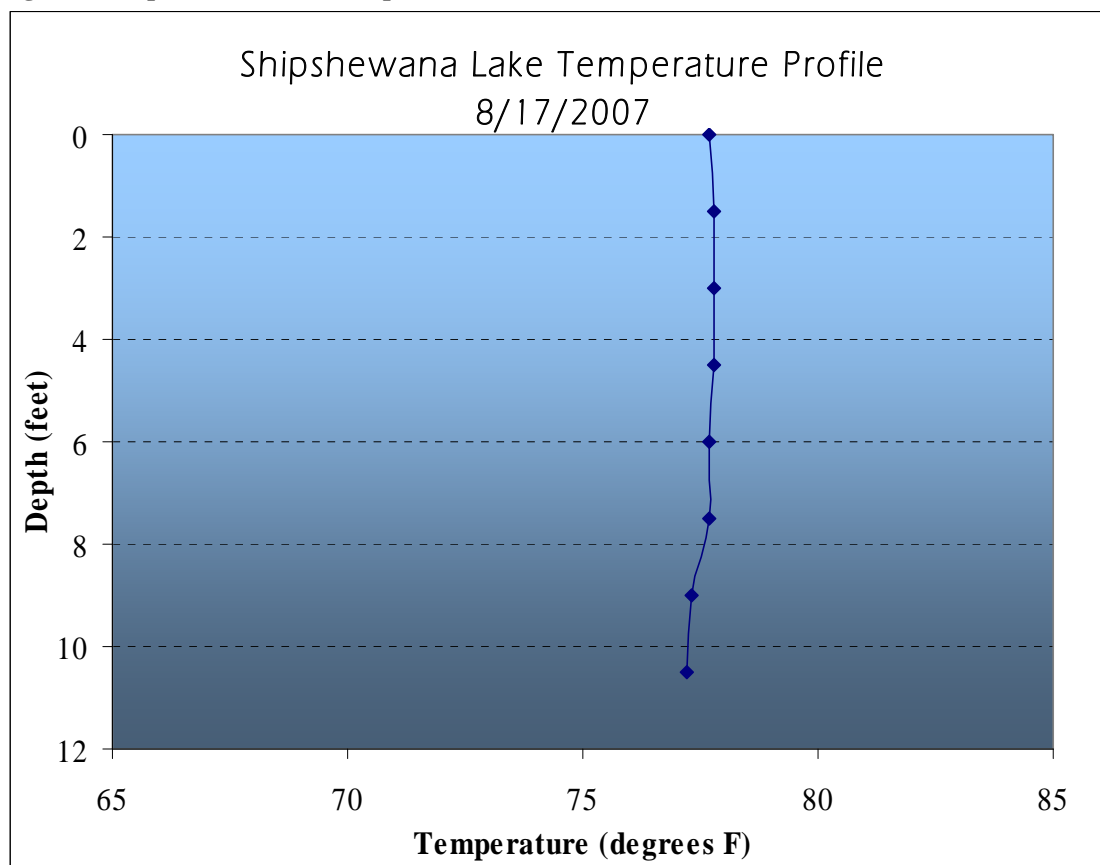
The thermocline is a rapid temperature change associated with the transition from surface water to deep water. In Shipshewana Lake water temperature remains stable from the surface down to 11 feet. This indicates that no thermocline was present at the time these measurements were taken.

3.0 Lake Uses Update

Shipshewana Lake has 2 public access points. One DNR public access site is located on the south shore of the lake and has very limited parking. A newer boat ramp has been constructed on the west shore of the lake with a larger parking area. The new boat ramp will increase public access to Shipshewana Lake. Figure 3 shows the west boat ramp at Shipshewana Lake.

Figure 3: Shipshewana Lake West Access Site

Based on survey data, personal observation, and comments from lake residents, public access to the lake was greatly improved by the whole lake sonar treatment. Prior to treatment, excessive vegetation significantly impaired boat travel from the north end of the lake to the south end of the lake. After treatment, both fishermen and other boaters could move more easily from one end of the lake to the other. Drift fishing for panfish is very popular on Shipshewana Lake. Areas of matted vegetation made this practice very difficult in many areas of the lake prior to treatment. Figure 4 shows fishing boats on Shipshewana Lake after treatment in August of 2007.

Figure 4: Drift Fishing on Shipshewana Lake

4.0 Fisheries

District 2 Fisheries Biologist, Neil Ledet, was contacted to determine the most recent fisheries survey data for Shipshewana Lake. Six fisheries surveys have been conducted on Shipshewana Lake. These surveys have taken place in 1968, 1975, 1983, 1986, 1989, and 2002. The most recent fisheries survey (June 3-7, 2002) used electro-fishing, gill nets, and trap nets to collect 1,424 fish with a total weight of 917 pounds (Koza 2002).

Fifteen species of fish were collected, with black crappies being the most abundant fish by number (34%) and carp having the largest total weight (36.2%). Bluegills were the second most abundant fish by number (28.3%), and golden shiners were third at 8.4%. Yellow perch were fourth in abundance at 7.4 %, and largemouth bass were fifth at 7.3%. Of the 104 largemouth bass collected, 9.6% were of harvestable length. Growth rates for all bass except for age IV + fish were above average for northern Indiana Lakes.

Northern Pike were stocked in Shipshewana Lake in 1985 and 1987. Initially, the pike population was stable, and 24 fish were collected in the 1989 survey, ranging from 17.7 to 33.0 inches. However, no northern pike were collected in the most recent fisheries survey (Koza 2002). Table 3 summarizes the most recent fisheries survey conducted by the IDNR.

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Table 3: 2002 IDNR Fisheries Survey Data

SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT					
*COMMON NAME OF FISH	NUMBER	PERCENT	LENGTH RANGE (inches)	WEIGHT (pounds)	PERCENT
Black crappie	487	34.2	2.7-10.2	111.49	12.2
Bluegill	403	28.3	2.1-9.2	79.06	8.6
Golden shiner	119	8.4	5.4-8.3	12.91	1.4
Yellow perch	106	7.4	6.9-11.8	33.13	3.6
Largemouth bass	104	7.3	4.5-19.1	74.89	8.2
White sucker	71	5.0	10.1-19.8	112.00	12.2
Common carp	44	3.1	10.2-33.3	332.15	36.2
Spotted gar	30	2.1	11.3-35.6	96.08	10.5
Yellow bullhead	22	1.5	6.5-12.3	12.51	1.4
Brown bullhead	16	1.1	7.1-13.3	12.49	1.4
Pumpkinseed	9	0.6	3.8-6.3	0.83	0.1
Bowfin	7	0.5	18.4-27.3	36.24	4.0
Warmouth	4	0.3	4.4-4.9	0.28	0.0
Channel catfish	1	0.1	20.3	3.16	0.3
Chestnut lamprey	1	0.1	7.3	0.00	0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
Total (15 Species)	1424	100.0		917.22	100.0

*Common names of fishes recognized by the American Fisheries Society.

5.0 Problem Statement

Eurasian watermilfoil no longer dominates the Shipshewana Lake plant community. The challenge in 2008 will be to identify areas of EWM re-growth through proper vegetation survey techniques and manage them effectively with herbicide treatments. Since some EWM re-growth is expected in 2008, spot treatments should be used to manage these smaller areas, as opposed to a whole lake treatment. Spot treatments will use 2, 4-D to control Eurasian watermilfoil.

6.0 Vegetation Management Goals and Objectives

The following management goals have been established by the IDNR for all Indiana lakes, including those applying for LARE funding. Any management practices implemented on Shipshewana Lake are to directly facilitate the achievement of these three goals:

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1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

Specific Objectives

One measurable goal for 2008 would be that no more than 5 acres of Eurasian watermilfoil would need treatment in Shipshewana Lake. Re-growth is expected over time, but ideally, this re-growth would be very minimal in 2008.

The major objective for Shipshewana Lake has changed from a large scale treatment effort to reduce the dominant milfoil population, to smaller scale treatments in areas where re-growth is observed in the future. These areas of re-growth will be treated with 2, 4-D herbicide.

7.0 Past Management Efforts

District 2 Fisheries Biologist, Neil Ledet, was contacted to determine any significant changes to vegetation control permits on Shipshewana Lake. The only major changes have been the LARE funded herbicide treatments. On July 12, 2006, approximately 15 acres of Shipshewana Lake were treated with 2, 4-D to alleviate severe matting of Eurasian watermilfoil and coontail in the south end of Shipshewana Lake. This treatment area was located inside the problem plant area outlined in yellow in figure 5. This dense plant bed was nearly cutting the lake in half, making it extremely difficult for a boat to travel from the public access site to the north end of the lake. This treatment was sponsored by the LARE program and the lake association to provide some temporary relief until a larger management strategy could be developed. Even after this treatment, matted vegetation still impeded boat traffic. This area is outlined in figure 5.

Figure 5: 2006 Treatment Area

Shipshewana Lake Problem Plant Bed: Outlined in Yellow
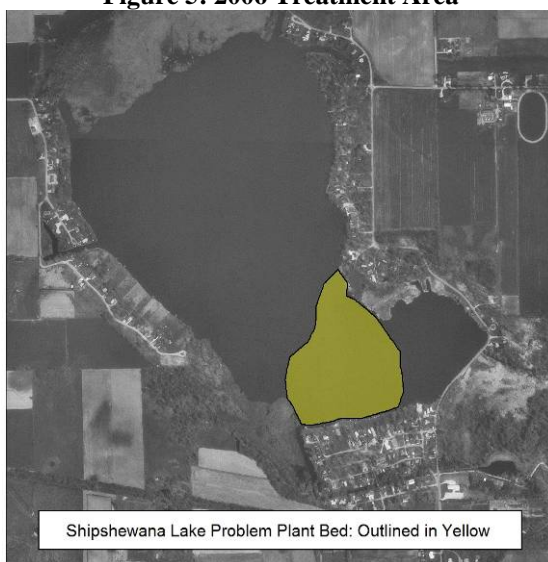
Even though the bed in figure 5 was very problematic, it was not the only plant bed where Eurasian watermilfoil was found. Eurasian watermilfoil was present throughout the lake.

Figure 6 shows Eurasian watermilfoil distribution in Shipshewana Lake prior to the Sonar treatment in 2007.

Figure 6: Pre-Treatment Eurasian Watermilfoil Distribution

Shipshewana Lake Eurasian Watermilfoil Locations   May 3, 2007
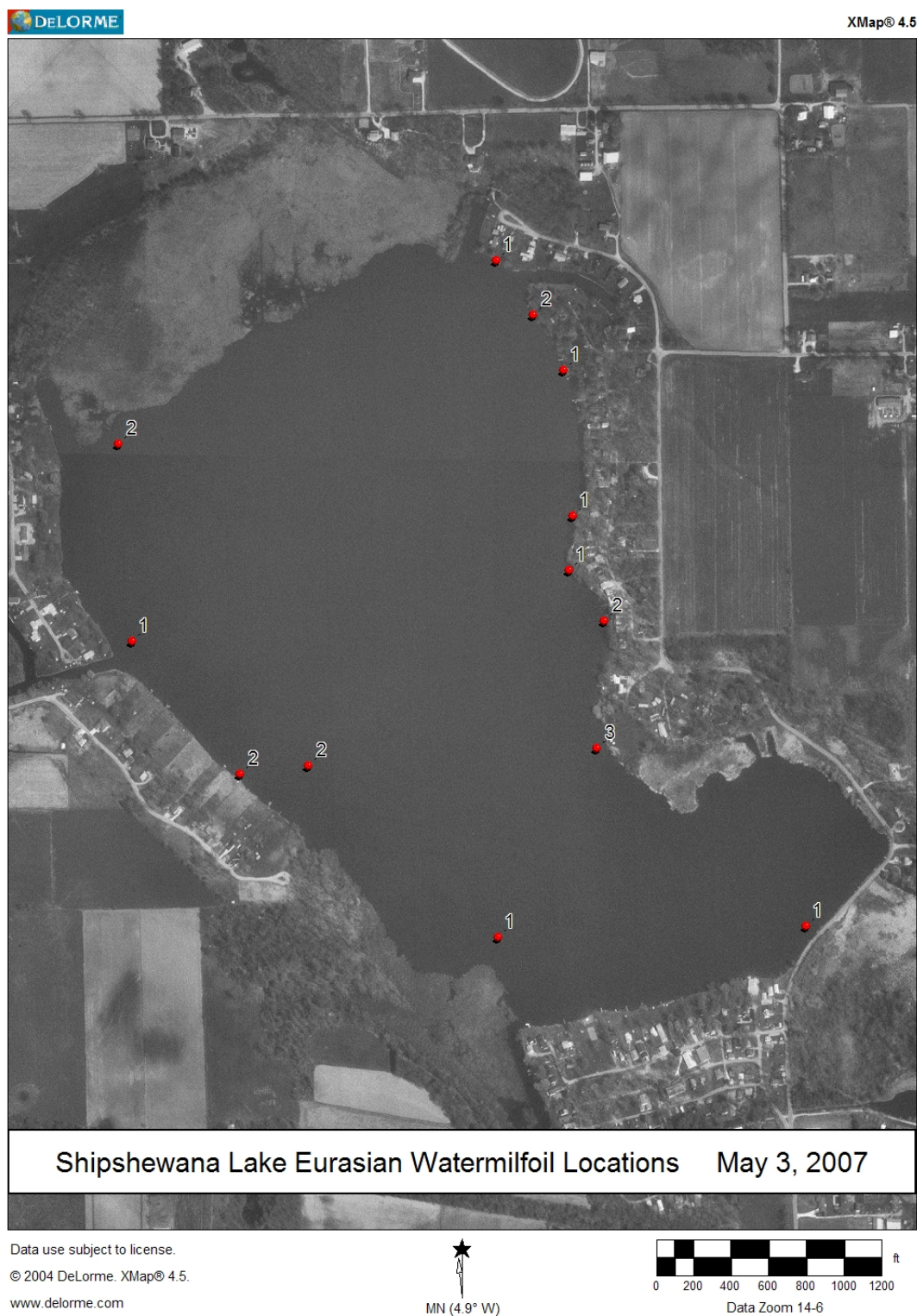
Sediment and Nutrients

In addition to the dredging project and herbicide treatments, two small ponds have been constructed on the ditch that enters Shipshewana Lake on its south side. These ponds act as a catch basin for nutrients and sediment coming through this ditch. These ponds were found to be infested with Eurasian watermilfoil and were treated with Sonar to prevent rapid re-infestation after the whole lake Sonar treatment.

Several other studies have been conducted on Shipshewana Lake Since 1989. They contain useful information on management activities that have taken place in the past on Shipshewana Lake. Some of these studies are listed below. These studies can be found on the LARE program website at the following address:
http://www.in.gov/dnr/fishwild/lare/lare_reports.html

Shipshewana Lake Restoration Feasibility Study. March 1989. International Science and Technology Inc. 11260 Roger Bacon Drive Suite 201. Reston Virginia 22090
**Shipshewana Lake Pre-Design Report**. January 1996. F.X. Browne Inc. 220 South Broad Street. Lausdale, PA. 19446

Shipshewana Lake Shoreline Stabilization Report. January 1996. F.X. Browne Inc. 220 South Broad Street. Lausdale, PA. 19446

Contract Documents and Specifications for the Construction of Shipshewana Lake Restoration Project: Two Constructed Wetlands. March 1998. F.X. Browne Inc. 220 South Broad Street. Lausdale, PA. 19446

Shipshewana Lake Dredging Project. April 1998. F.X. Browne Inc. 220 South Broad Street. Lausdale, PA. 19446

2007 Sonar Application

On May 3, 2007, the entire lake was treated with Sonar at a total rate of 8 parts per billion (ppb). The LARE program helped to fund a rate of 6ppb to control Eurasian watermilfoil and gave approval for the lake association to privately fund the addition of 2 ppb to help reduce the coontail population. The herbicide was applied using underwater injection systems from 2 of Aquatic Weed Control's application boats. It was applied in a zigzag pattern over the entire lake. Sonar was also applied in the small pond that flows into Shipshewana Lake's south end to protect against re-infestation. FasTESTS were taken approximately 3 weeks after treatment and found that Sonar rates in Shipshewana Lake ranged from 6 to 12 parts per billion. Because the results were slightly higher than anticipated, SePRO advised Aquatic Weed Control not to bump the concentration but to take another FasTEST later to ensure that the herbicide was remaining in the water column. A second round of FasTESTS were collected on June 8 and still showed Sonar concentrations from 1.3 to 3.1 parts per billion, so a bump was not recommended.

Sonar works by prohibiting the plant from making chlorophyll, which in turn prevents the plant from making food. This whitening of plant material due to a lack of chlorophyll is

called chlorosis. Figure 7 shows coontail collected from Shipshewana Lake approximately 3 weeks after treatment. This coontail was exhibiting Sonar damage, as indicated by the whitening of the leaves.

Figure 7: Coontail Showing Chlorosis from Sonar

Before the whole lake Sonar treatment, herbicide applications were limited to contact herbicides applied along lake frontages at the request of property owners. These treatments have been very limited. One area treated on a regular basis is the beach area for the Brethren Camp on Shipshewana Lake. Other treatments are very sporadic and usually only involve 50-100 feet of frontage.

8.0 Aquatic Plant Community Characterization

One major change in protocol for 2007 is the absence of the Tier I reconnaissance survey. Survey intensity is now being tailored to individual lakes, depending on their own unique set of circumstances and management activities. Some lakes which may have been surveyed twice annually in the past may only be surveyed once each season. Surveys on some lakes that have been intensely surveyed in recent years may change to visual surveys as opposed to more time consuming quantitative vegetation surveys. These changes provide better quality of service and more efficient use of funding on Indiana lakes.

An updated Tier II survey protocol has been established by the IDNR. These changes are outlined in the methods section (8.1).

8.1 Methods Update

The Tier II survey protocol was updated by the IDNR in 2007. The 2006 LARE Tier II protocol required that sample sites be stratified by depth contour and that data analysis be provided for each depth contour. Rake scores for plant species are recorded as 1, 3, or 5, as opposed to the original scoring system of 1, 2, 3, 4, or 5.

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The number of sample sites needed for a Tier II survey still is based on lake size as it was in 2006. Trophic state describes the productivity of a lake and is correlated with plant growth, secchi disk, and nutrient availability. There are 4 different trophic states listed by the IDNR: oligotrophic, mesotrophic, eutrophic, and hypereutrophic. Oligotrophic lakes usually have clear water and few nutrients, while Hypereutrophic lakes usually have deeply stained water and are nutrient rich. Table 3 is taken from the IDNR 2006 Tier II protocol and shows the maximum depth that must be sampled for a lake in each trophic state. In oligotrophic lakes, where water is clear, plants may be able to grow in up to 25 feet of water because sunlight may still reach the lake bottom in deep water. In hypereutrophic lakes where water is turbid, lack of sunlight will prevent plants from growing in deep water, so the maximum sampling depth is only 10 feet.

Table 3: Sample Depth by Trophic State

Trophic State	Maximum Depth of Sampling (ft)
Hypereutrophic	10
Eutrophic	15
Mesotrophic	20
Oligotrophic	25

Table 4 is used to calculate the number of sample sites need in each depth contour by using lake size and trophic status. The new protocol attempts to more accurately describe the entire littoral zone of a lake and provide more detailed data analysis by separating the littoral zone into 5 foot depth segments.

Table 4: Sample Sites by Lake Size and Trophic State

Tier II Sampling   3

Table 3. Sample size requirements as determined by lake size, trophic state, and apportioned by depth class.

Lake Acres	Total # of Sites	Hypereutrophic		Eutrophic			Mesotrophic				Oligotrophic				
		0-5 foot contour	5-10 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	20-25 foot contour
<10	20	10	10	10	7	3	10	5	3	2	10	4	3	2	1
10-49	30	20	10	10	10	10	10	10	7	3	10	10	5	3	2
50-99	40	30	10	17	13	10	10	10	10	10	10	10	10	7	3
100-199	50	40	10	23	17	10	14	14	12	10	10	10	10	10	10
200-299	60	50	10	30	20	10	18	16	16	10	14	12	12	12	10
300-399	70	60	10	37	23	10	22	20	18	10	17	15	14	14	10
400-499	80	70	10	43	27	10	25	23	22	10	19	18	17	16	10
500-799	90	80	10	50	30	10	29	27	24	10	22	21	19	18	10
>=800	100	90	10	57	33	10	33	31	26	10	25	23	22	20	10

Shipshewana Lake is classified as hypereutriophic by the IDNR with and has 202 acres. Based on these characteristics, 60 sites are divided between the 0 – 5 foot and the 5 – 10 Foot depth contours of the Lake, with 50 of these sites being taken between 0 and 5 feet deep.

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8.2 Results

8.2.2 Tier II Results

Tier II surveys were conducted on Shipshewana Lake on May 3, 2007 and August 17, 2007. Secchi disk measurements were recorded at 2.5 feet and 2.3 feet in these surveys. In both surveys, maximum plant depth was approximately 6 feet deep.

In both surveys, sixty rake samples were distributed throughout each 5 foot depth contour of the littoral zone. A total of 5 species of submersed aquatic plants were collected during the spring survey, while 2 plant species were found during the fall survey. Figure 8 shows the locations of all sample sites for the 2007 Tier II surveys.

Figure 8: 2007 Tier II Sample Locations
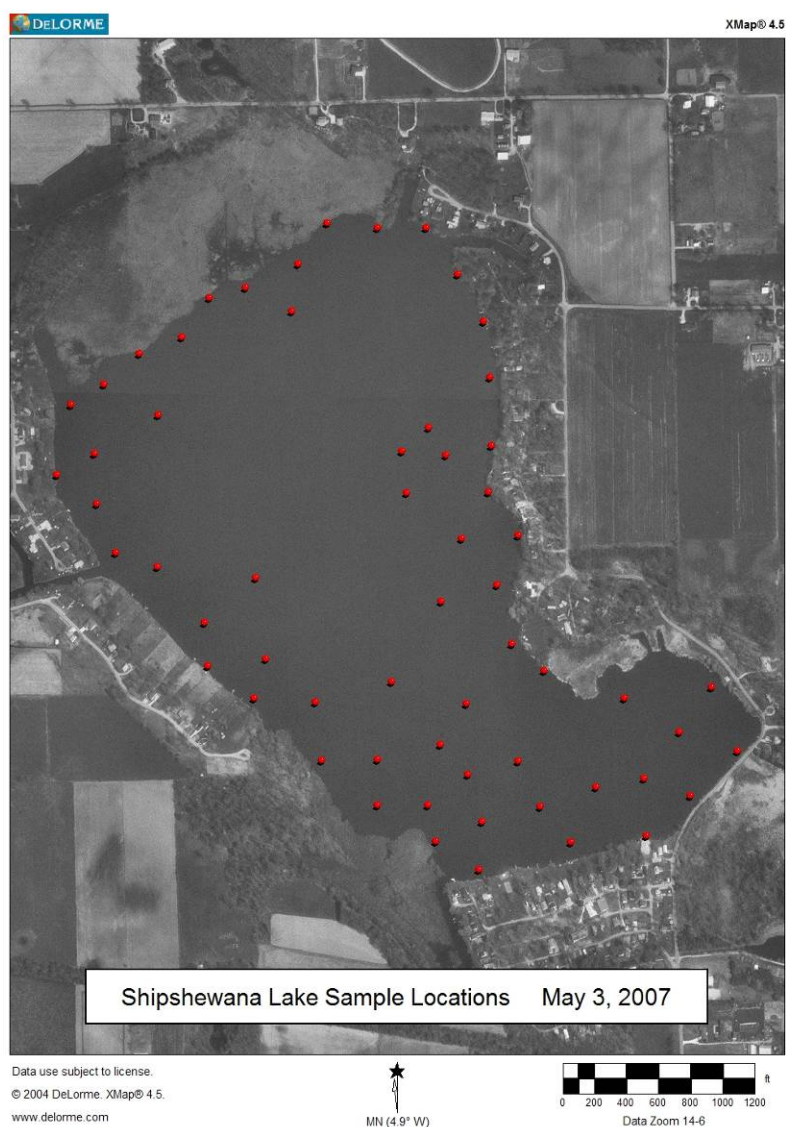
Spring Data Analysis

Tables 5 through 10 are data summaries for the May 3, 2007 aquatic vegetation survey. These tables help to describe the plant community and will help identify any changes that take place in the years to come. Tables labeled "Overall" include every sample site, while the other tables describe each depth contour of the lake's littoral zone (0-5 feet, 5-10 feet, etc).

Table 5: May 2007 Data Analysis - Overall

Occurrence and Abundance of Submersed Aquatic Plants - Overall

Lake:	Shipshewana	Secchi:	2.5	SE Mean Species/site:	0.09
Date:	5/3/07	Littoral sites with plants:	46	Mean natives/site:	0.80
Littoral depth (ft):	6.0	Number of species:	5	SE Mean natives/site:	0.07
Littoral sites:	53	Maximum species/site:	2	Species diversity:	0.45
Total sites:	60	Mean number species/site:	1.03	Native diversity:	0.16

Common Name	Site Frequency	Score Frequency 1	Score Frequency 3	Score Frequency 5	Dominance
Coontail	73.3	18.3	36.7	18.3	44.0
Eurasian Watermilfoil	21.7	11.7	10.0	0.0	6.7
Sago Pondweed	5.0	5.0	0.0	0.0	1.0
Curly-leaf Pondweed	1.7	1.7	0.0	0.0	0.3
Elodea	1.7	1.7	0.0	0.0	0.3
Filamentous Algae	31.7				

Table 6: May 2007 Data Analysis   0 - 5 Feet

Occurrence and Abundance of Submersed Aquatic Plants 0-5 Feet

Lake:	Shipshewana	Secchi:	2.5	SE Mean Species/site:	0.09
Date:	5/3/07	Littoral sites with plants:	45	Mean natives/site:	0.94
Littoral depth (ft):	6.0	Number of species:	5	SE Mean natives/site:	0.06
Littoral sites:	50	Maximum species/site:	2	Species diversity:	0.45
Total sites:	50	Mean number species/site:	1.22	Native diversity:	0.16

Common Name	Site Frequency	Score Frequency 1	Score Frequency 3	Score Frequency 5	Dominance
Coontail	86.0	20.0	44.0	22.0	52.4
Eurasian Watermilfoil	26.0	14.0	12.0	0.0	10.0
Sago Pondweed	6.0	6.0	0.0	0.0	1.2
Curly-leaf Pondweed	2.0	2.0	0.0	0.0	0.4
Elodea	2.0	2.0	0.0	0.0	0.4

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Table 7: May 2007 Data Analysis 5 - 10 Feet

Occurrence and Abundance of Submersed Aquatic Plants 5-10 Feet					
Lake:	Shipshewana	Secchi:	2.5	SE Mean Species/site:	0.1
Date:	5/3/07	Littoral sites with plants:	1	Mean natives/site:	0.10
Littoral depth (ft):	6.0	Number of species:	1	SE Mean natives/site:	0.10
Littoral sites:	3	Maximum species/site:	1	Species diversity:	0.00
Total sites:	10	Mean number species/site:	0.10	Native diversity:	0.00

		Score Frequency			
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	10.0	10.0	0.0	0.0	2.0

No plants were collected in the 10 -15 foot depth contour.

Tables 8 through 10 are data summaries for the August 17, 2007 aquatic vegetation survey.

Table 8: August 2007 Data Analysis - Overall

Occurrence and Abundance of Submersed Aquatic Plants - Overall					
Lake:	Shipshewana	Secchi:	2.3	SE Mean Species/site:	0.07
Date:	8/17/07	Littoral sites with plants:	23	Mean natives/site:	0.42
Littoral depth (ft):	6.0	Number of species:	2	SE Mean natives/site:	0.07
Littoral sites:	53	Maximum species/site:	2	Species diversity:	0.21
Total sites:	60	Mean number species/site:	0.42	Native diversity:	0.21

		Score Frequency			
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	36.7	26.7	10.0	0.0	11.3
Sago Pondweed	5.0	5.0	0.0	0.0	1.0
Filamentous Algae	36.7				

Table 9: August 2007 Data Analysis 0 - 5 Feet

Occurrence and Abundance of Submersed Aquatic Plants 0-5 Feet					
Lake:	Shipshewana	Secchi:	2.3	SE Mean Species/site:	0.08
Date:	8/17/07	Littoral sites with plants:	22	Mean natives/site:	0.48
Littoral depth (ft):	6.0	Number of species:	2	SE Mean natives/site:	0.08
Littoral sites:	50	Maximum species/site:	2	Species diversity:	0.22
Total sites:	50	Mean number species/site:	0.48	Native diversity:	0.22

		Score Frequency			
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	42.0	30.0	12.0	0.0	13.2
Sago Pondweed	6.0	6.0	0.0	0.0	1.2
Filamentous Algae	44.0				

Table 10: August 2007 Data Analysis 5 - 10 Feet

Occurrence and Abundance of Submersed Aquatic Plants 5-10 Feet						

Lake:	Shipshewana	Secchi:		2.3	SE Mean Species/site:	0.10
Date:	8/17/07	Littoral sites with plants:		1	Mean natives/site:	0.10
Littoral depth (ft):	6.0	Number of species:		1	SE Mean natives/site:	0.10
Littoral sites:	3	Maximum species/site:		1	Species diversity:	0.00
Total sites:	10	Mean number species/site:		0.10	Native diversity:	0.00

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	10.0	10.0	0.0	0.0	2.0
Filamentous Algae	0.0				

Site Frequency

Site frequency is a measure of how often a species was collected during the Tier II survey. It can be calculated by the following equation:

Site Frequency = (# of sites where the species was collected) X 100
                                    Total # of littoral sample sites

Table 11 shows site frequencies for every plant collected in between fall 2006 and fall 2007. The Sonar treatment took place after the spring 2007 survey. Coontail was the most commonly collected plant in all surveys. Eurasian watermilfoil site frequency dropped from 55.0 in fall of 2006 to 0 in fall of 2007.

Table 11: Shipshewana Lake Site Frequency History

Shipshewana Lake
Site Frequencies 2006-2007
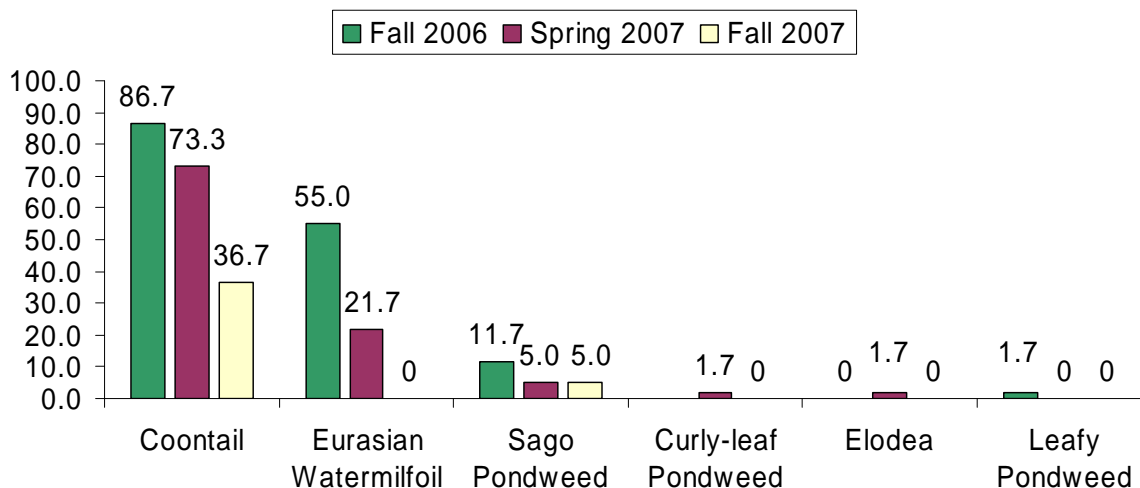
Species Diversity

The species diversity indices listed in the data analysis tables help to describe the overall plant community. A species diversity index is actually measured as a value of uncertainty (H). If a species is chosen at random from a collection containing a certain number of species, the diversity index (H) is the probability that a chosen species will be different from the previous random selection. The diversity index (H) will always be between 0 and 1. The higher the H value, the more likely it is that the next species chosen from the collection at random will be different from the previous selection (Smith, 2001). This index is dependent upon species richness and species evenness, meaning that species diversity is a function of how many different species are present and how evenly they are spread throughout the ecosystem.

The overall species diversity index for Shipshewana Lake in August 2007 was 0.21, down from 0.56 in 2006. Both of these values are low when compared to other Indiana lakes (Pearson 2004). Native plant diversity in August of 2007 was 0.21, down slightly from 0.24 in August of 2006.

Species Dominance

Species dominance is dependent upon how many times a species occurs, and its relative coverage area or biomass within the system. In this survey, the abundance rating given to each species at each sample site was used to determine dominance. The dominance of a particular species in this Tier II survey increases as its site frequency and relative abundance increase.

Table 12 tracks dominance values for each plant collected at Shipshewana Lake during the fall 2006 and fall 2007 surveys. Trends are similar to sight frequency, with coontail being by far the most dominant plant in the fall survey. Eurasian watermilfoil dominance dropped to 0 after treatment in 2007.

Table 12: 2006 – 2007 Species Dominance
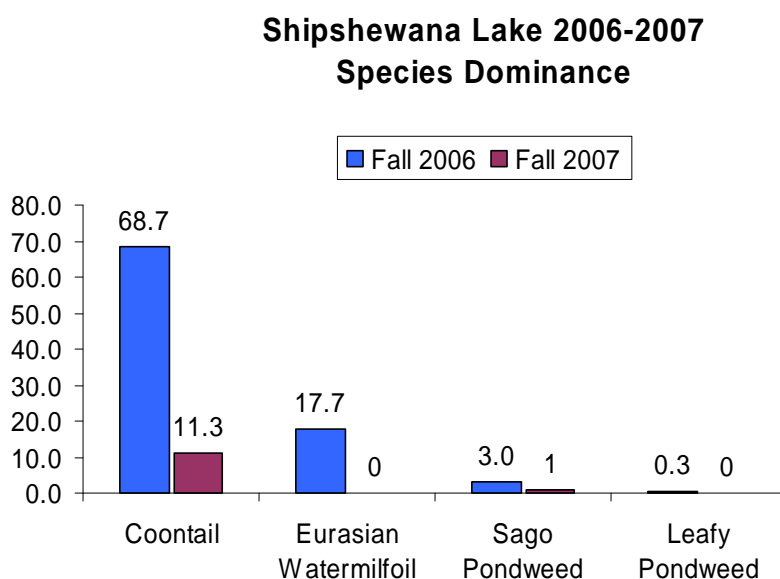
8.3 Macrophyte Inventory Discussion

Submersed aquatic vegetation covers an estimated 114 acres, or 56% of Shipshewana Lake's total surface area. Of these 114 acres, at least 40 of them contained Eurasian watermilfoil beds prior to the whole lake Sonar treatment.

Based upon 2007 survey data, Shipshewana Lake has a very low diversity of submersed aquatic plant community when compared with many area lakes.   Species richness in Shipshewana Lake was low with only 5 submersed species collected in May of 2007 and only 2 species collected in August of 2007 after treatment. Coontail is by far the most dominant species and will likely continue its dominance. Planktonic algal blooms have historically occurred each summer and will likely continue, giving the water lime green coloration. Figure 9 shows green planktonic algae concentrated at a windward shoreline in Shipshewana Lake.

Figure 9: Shipshewana Lake Planktonic Algae

As mentioned in the 2006 vegetation management plan, the nutrient rich water of Shipshewana Lake poses many challenges to vegetation management. The re-colonization of native plants in areas previously occupied by EWM may be inhibited by the turbidity of the water. Coontail, a native plant which does well in turbid water, could increase to nuisance levels very quickly. Based on results of other whole lake Sonar treatments, sago pondweed abundance may be expected to increase in the lake. It is hoped that it might become dominant in areas where EWM was prevalent. However, a quick re-colonization of the lake by beneficial native plants other than coontail should not be expected.

Aquatic
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Threatened and Endangered Species

The Indiana Natural Heritage Data Center has compiled a list of Indiana plant species that are federally or state listed as endangered, threatened, or rare. The following is an excerpt taken directly from the Indiana Natural Heritage Database website.   Link: Indiana Natural Heritage Data Center.

"The Indiana Natural Heritage Data Center, set up in 1978, represents a comprehensive attempt to determine the state's most significant natural areas through an intensive statewide inventory. The Indiana Natural Heritage Data Center is part of the Natural Heritage Network, a worldwide system of Heritage Programs. This program is designed to provide information about Indiana's diversity of natural ecosystems, species, landscape features, and outdoor amenities, and to assure adequate methods for evaluating this information and setting sound land protection priorities. The inventory is a continuous process, becoming an increasingly valuable tool for decision makers and scientists as it progresses."

No state or federally listed plant species were found in Shipshewana Lake in 2007.

9.0 Aquatic Plant Management Alternatives

Management practices for the control of EWM have not changed significantly since the 2006 lake management plan.

As outlined in the treatment strategy, 2, 4-D will be used to treat areas of Eurasian watermilfoil re-growth. Plants in Shipshewana Lake grow to a depth of at least 6 feet. Using 2, 4-D should provide very similar control to Renovate, while greatly reducing cost in the deeper treatment areas.

The Shipshewana Community Lake Improvement Association has helped to co-sponsor many sediment and nutrient removal activities on the lake and has participated in a volunteer monitoring program in the early 1990's.

Sediment and nutrient control is very important for Shipshewana Lake. There are two ponds designed to act as a sediment trap on the inlet on the south side of the lake near the IDNR public access site. This sediment trap was infested with Eurasian watermilfoil as well and was treated with Sonar in 2007 to prevent re-infestation in Shipshewana Lake.

10.0 Public Involvement

A LARE meeting was held on November 8, 2007 to discuss issues pertaining to Shipshewana Lake. District 2 Fisheries Biologist, Neil Ledet, a lake representative, Aquatic Weed Control and LARE Aquatic Biologist, Gwen White, were all present and discussed the plant community of Shipshewana Lake.

A public lake meeting was held for Shipshewana Lake on June 23, 2007. Fifteen people were in attendance. All 15 people in attendance indicated that they owned property around Shipshewana Lake. Jim Donahoe of Aquatic Weed Control summarized LARE management activities and outlined the future management strategy for maintaining the Eurasian

watermilfoil population at a low level with spot herbicide treatments. Residents were pleased with the outcome of the whole lake treatment and commented that the algal blooms after the Sonar treatment may not have been as severe as in past years in which no treatments were conducted. Figure 10 shows responses to the public questionnaire.

Figure 10: Shipshewana Lake Public Questionnaire

Lake Use Survey (15 total)   Lake name __Shipshewana__

Are you a lake property owner?   Yes __15__   No __O__

Are you currently a member of your lake association?   Yes __14__ No __1__

How many years have you been at the lake?
- 2 or less – 1
- 2 – 5 years – 3
- 5-10 years – 4
- Over 10 years – 7

How do you use the lake (mark all that apply)
- _5_ Swimming   _O_ Irrigation
- _13_ Boating   _O_ Drinking water
- _15_ Fishing   _O_ Other _____

Do you have aquatic plants at your shoreline in nuisance quantities?   Yes _3_ No _9_

Do you currently participate in a weed control project on the lake?   Yes _9_ No _2_

Does aquatic vegetation interfere with your use or enjoyment of the lake?   Yes _9_ No _5_

Does the level of vegetation in the lake affect your property values?   Yes _13_ No _2_

Are you in favor of continuing efforts to control vegetation on the lake?   Yes _14_ No _O_

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded?   Yes _13_ No _1_

Mark any of these you think are problems on your lake:
- _O_ Too many boats access the lake
- _O_ Use of jet skis on the lake
- _O_ Too much fishing
- _O_ Fish population problem
- _4_ Dredging needed
- _O_ Overuse by nonresidents
- _6_ Too many aquatic plants
- _O_ Not enough aquatic plants
- _6_ Poor water quality
- _2_ Pier/funneling problem

Please add any comments:
Deeper lake = less problem; bad erosion on channel shoreline reducing property line edge – what can be done to fill it back in to prevent further erosion; weed control has helped; 1st season of lake with aquatic treatment appears successful 2006 efforts in July=catastrophe; end up with large biomass on southside; were pleased with weed control this year – hopefully will continue. Need more weed banks + aquatic plants control (lilly pads + cattails).

11.0 Public Education

The Shipshewana Lake association is active and holds two meetings per year with good attendance (~50 %). More information on stopping the spread of invasive aquatic organisms can be found at http://www.protectyourwaters.net/. These items include thoroughly cleaning equipment after use in a lake and removing all water from bilges, livewells, etc.

Hydrilla

Hydrilla (*Hydrilla verticillata*) is an invasive aquatic plant species common throughout the southern United States. It it federally listed as a noxious weed and causes severe ecological and recreational problems wherever it grows. It is considered to be much more destructive than other invasives like Eurasian watermilfoil and curly leaf pondweed because of its reproductive adaptations. It grows by fragmentation, as does Eurasian watermilfoil, but it also produces turions which can remain dormant in the sediment for 4 years or more (Van and Steward, 1990). It produces tubers at its root tips which can also reproduce after multiple years of dormancy. It can grow 1 inch each day and it quickly out-competes native plants. It forms dense beds that eliminate native plants, stunt fish populations, impede recreation and cause a drastic decrease in biodiversity (Colle and Shireman, 1980). Millions of dollars are spent each year for hydrilla maintenance each year in Florida alone. Eradication is unlikely once a population has been well established, although eradication has been achieved in newly infested waters using a herbicide called Sonar. Sonar is applied at a rate of 6 parts per billion and this concentration is maintained in the water for 180 days. Early detection can be crucial to an effective eradication program, and all lake residents and users are encouraged to be on the look-out for this invader.
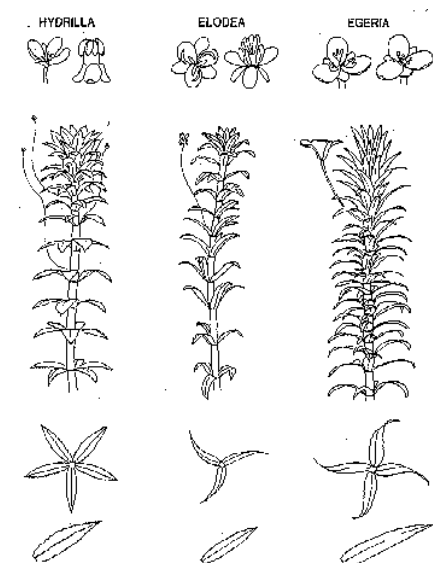
In fall of 2006, this plant was found in Lake Manitou, in Rochester, Indiana. This is the first instance of hydrilla in the upper Midwest. Prior to its appearance in Lake Manitou, The closest infestations of hydrilla were in Tennessee and Pennsylvania.

Hydrilla can easily be confused with native elodea. The major difference is that elodea has sets of leaves on the stem in whorls of three, while hydrilla usually has whorls of 5 leaves, although 4 to 9 leaves per whorl are possible with hydrilla. Hydrilla will also have small serrations on the leaf edges. More information on hydrilla can be found at the University of Florida's Center for Aquatic Invasive Plants (http://plants.ifas.ufl.edu/). More general information on aquatic invaders can be found at www.protectyourwaters.net.

12.0 Integrated Treatment Action Strategy

Eurasian watermilfoil was not found in Shipshewana Lake in fall of 2007. Based on results from other whole lake Sonar treatments, only minimal re-growth should be expected in 2008. Any areas of Eurasian watermilfoil re-growth should be identified and treated with 2, 4-D herbicide. 2, 4-D and Renovate are the most common herbicides used for spot treatments of Eurasian watermilfoil. Both herbicides provide effective control, but using 2, 4-D will greatly reduce costs to the association. A vegetation control permit will be submitted without a treatment map for 2008, since no re-growth has occurred to this point. The permit will request treatment of up to 5 acres of Eurasian watermilfoil. If Eurasian watermilfoil returns to the lake in 2008, it will be detected in the vegetation surveys, and spot treatments using 2,4-D would be used to control the EWM.

Maintenance of the Eurasian watermilfoil population should be the highest priority. Spot herbicide treatments should be limited to areas of Eurasian watermilfoil infestation to protect the native species that are re-colonizing the lake. Treatment of native plants along shorelines of the main lake will not be permitted in 2008. This may help give the native plants a competitive advantage over Eurasian watermilfoil.

In addition to herbicide treatments, all stakeholders in the Shipshewana Lake watershed are encouraged to take actions to reduce nutrient flow into Shipshewana Lake. Those living near the lake should try to minimize runoff of nutrients into the lake from their property. Using low phosphorus fertilizer and ensuring proper septic maintenance are small steps that could help improve water quality. Farmers within the watershed may want to take advantage of financial assistance from the Indiana Conservation Reserve Program. Cost shares and yearly payments are available for the construction of sod waterways and warm season grass plantings that can help reduce agricultural runoff to Shipshewana Lake.

Herbicide Specifications
In treatment areas on Shipshewana Lake 2, 4-D should be applied at a rate of 1.76 parts per million to achieve adequate control of Eurasian Watermilfoil.

13.0 Project Budget

In following the 3-year plan for Shipshewana Lake, $1,875 should be set aside to treat up to 5 acres of EWM re-growth in 2008. Treatment may not be necessary, but funds must be in place in case re-growth does occur. Up to $4,000 should be set aside for survey and planning costs in 2008. This $4,000 will be eligible for a 90% cost share by the LARE program, so the association would likely be responsible to pay $400 for survey and planning costs.

Table 13 outlines cost estimates for the Sonar treatment program. These costs are estimates only and are subject to change pending future herbicide pricing.

Table 13: Shipshewana Lake 3 Year Cost Estimates

Project (Shipshewana Lake - 202 acres)	2007	2008	2009	3 Year Cost Totals
Whole Lake Fluridone Treatment - 6ppb				
Total Estimated Costs	$ 26,300	$0	$0	**$ 33,250**
LARE share – subject to availability	$ 23,670			**$ 27,045**
Association's Share	$ 2,630			**$ 6,205**
Additional 2 ppb to Control Coontail Additional Cost to Association (Not Eligible for LARE Funding)	$3,200			
Follow Up Spot Treatments using 2, 4-D		Up to 5 acres if needed		
Total Estimated Costs	$0	$ 1,875	$ 1,875	
LARE Share – subject to availability		$1687.50	$1687.50	
Association's Share		$187.50	$187.50	

14.0 Monitoring and Plan Update Procedures

In 2008, a spring visual survey will be conducted to search for any areas of Eurasian watermilfoil re-growth. Should any Eurasian watermilfoil be found, a treatment map will be submitted to the IDNR. Herbicide treatment would follow the approval of the treatment map.

A late season Tier II vegetation survey is recommended for Shipshewana Lake in 2008. This survey will help describe how the plant community is responding to the whole lake treatment.

In the years that follow, additional surveys should be conducted to determine how the Eurasian milfoil population is reacting to the management strategy over a long period of time. These surveys will provide a basis for evaluation of the management strategy and can be presented to the public should the need arise to modify the management strategy. They will also serve to keep the public interested and informed about management practices at the lake so they will be motivated and equipped to actively participate in the conservation of the Shipshewana Lake ecosystem. The intensity and frequency of vegetation surveys may change from year to year. Survey and planning needs should be re-evaluated each year to reduce unnecessary cost to the lake association while still providing adequate data to characterize the plant community.

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15.0 References

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16.0 Appendices

16.1 Calculations

Fluridone Calculations:
The following paragraph is taken directly from the Sonar A.S. label. It outlines the specific procedures for calculating the amount of Fluridone needed to treat a body of water.

Application Rate Calculation - Ponds, Lakes and Reservoirs
The amount of Sonar A.S. to be applied to provide the desired ppb concentration of active ingredient in treated water may be calculated as follows:
Quarts of Sonar A.S. required per treated surface acre =
Average water depth of treatment site (feet)
x Desired ppb concentration of active ingredient
x 0.0027
For example, the quarts per acre of Sonar A.S. required to provide a concentration of 25 ppb of active ingredient in water with an average depth of 5 feet is calculated as follows:
5 **x** 25 **x** 0.0027 = 0.33 quarts per treated surface acre
When measuring quantities of Sonar A.S., quarts may be converted to fluid ounces by multiplying quarts to be measured **x** 32. For example, 0.33 quarts **x** 32 = 10.5 fluid ounces.
Note: Calculated rates should not exceed the maximum allowable rate in quarts per treated surface acre for the water depth listed in the application rate table for the site to be treated.

The following chart outlines rate calculations for DMA – 4 IVM Herbicide. It was taken directly from the DMA – 4 IVM specimen label on Dow AgroSciences website. http://www.dowagro.com/ivm/invasive/prod/dma.htm

Submerged Aquatic Weeds: Including Eurasian Water Milfoil *(Myriophyllum spicatum)*

Treatment Site	Maximum Application Rate [†]	Specific Use Directions
Aquatic Weed Control in Ponds, Lakes, Reservoirs, Marshes, Bayous, Drainage Ditches, Canals, Rivers and Streams that are Quiescent or Slow Moving, Including Programs of the Tennessee Valley Authority	2.84 gallons (10.8 lb of acid equivalent) per acre foot	**Application Timing:** For best results, apply in spring or early summer when aquatic weeds appear. Check for weed growth in areas heavily infested the previous year. A second application may be needed when weeds show signs of recovery, but no later than mid-August in most areas. **Subsurface Application:** Apply DMA 4 IVM undiluted directly to the water through a boat mounted distribution system. Shoreline areas should be treated by subsurface injection application by boat to avoid aerial drift. **Surface Application:** Use power operated boat mounted boom sprayer. If rate is less than 5 gallons per acre, dilute to a minimum spray volume of 5 gallons per surface acre. **Aerial Application:** Use drift control spray equipment or thickening agents mixed with sprays to reduce drift. Apply through standard boom systems in a minimum spray volume of 5 gallons per surface acre. For Microfoil® drift control spray systems, apply DMA 4 IVM in a total spray volume of 12 to 15 gallons per acre. Apply to attain a concentration of 2 to 4 ppm (see table below).

[†] DMA 4 IVM contains 3.8 lb of acid equivalent per gallon of product.

Amount to Apply to Attain a Concentration of 2 to 4 ppm			
Surface Area	Average Depth (ft)	2,4-D Acid Equivalent to Apply (lb/acre)	Amount of DMA 4 IVM to Apply (gal/acre)
1 acre	1	5.4 to 10.8	1.42 to 2.84
	2	10.8 to 21.6	2.84 to 5.68
	3	16.2 to 32.4	4.26 to 8.53
	4	21.6 to 43.2	5.68 to 11.37
	5	27.0 to 54.0	7.10 to 14.21

Aquatic Weed Control

The following table outlines rate calculations for Renovate 3 herbicide based on desired PPM and average depth of treatment area. It is taken directly from the Renovate 3 specimen label on SePRO Corporation's website: www.sepro.com

Concentration of Triclopyr Acid in Water (ppm ae)					
	Gallons of Renovate 3 per surface acre at specified depth				
Water Depth (feet)	0.75 ppm	1.0 ppm	1.5 ppm	2.0 ppm	2.5 ppm
1	0.7	0.9	1.4	1.8	2.3
2	1.4	1.8	3.3	3.6	4.6
3	2.1	2.9	4.1	5.4	6.8
4	2.7	3.6	5.4	7.2	9.1
5	3.4	4.5	6.8	9.0	11.3
6	4.1	5.4	8.1	10.9	13.6
7	4.8	6.3	9.5	12.7	15.8
8	5.5	7.2	10.9	14.5	18.1
9	6.1	8.1	12.2	16.3	20.4
10	6.8	9.0	13.6	18.1	22.6
15	10.2	13.6	20.4	27.2	33.9
20	13.6	18.1	27.2	36.2	45.3

16.2 Common Aquatic Plants of Indiana
(See 2006 Management Plan)

16.3 Pesticide Use Restrictions Summary:

The following table was produced by Purdue University and included in the Professional Aquatic Applicators Training Manual. It gives a summary of water use restrictions on all major chemicals available for use in the aquatics market.

Table 14: Pesticide Use Restrictions

Table 1. Aquatic Herbicides and Their Use Restrictions. Always check the label because these restrictions are subject to change.

| | Human | | | Animal | Irrigation | | |
	Drinking	Swimming	Fish Consumption	Drinking	Turf	Forage	Food Crops
	--- waiting period, in days ---						
Copper Chelate	0	0[a]	0	0	0	0	0
Copper Sulfate	0	0[a]	0	0	0	0	0
Diquat	1–3	0[a]	0	1	1–3	1–3	5
Endothall (granular)[b]	7	0[a]	3	0	7	7	7
Endothall (liquid)[b]	7–25	0[a]	3	7–25	7–25[d]	7–25	7–25
Endothall 191 (granular)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Endothall 191 (liquid)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Fluridone	0[e]	0[a]	0	0	7–30	7–30	7–30
Glyphosate	0[e]	0[a]	0	0	0	0	0
2,4-D (granular)	*	0[a]	0	*	*	*	*

[a]Although this compound has no waiting period for swimming, it is always advisable to wait 24 hours before permitting swimming in the direct area of treatment.
[b]Trade name is Aquathol®.
[c]Trade name is Hydrothol®.
[d]May be used for sprinkling bent grass immediately.
[e]Do not apply this product within 1/4 (fluridone) to 1/2 (glyphosate) mile upstream of potable water intakes.
*Do not use treated water for domestic purposes, livestock watering (2,4-D, dairy animals only), or irrigation.

Aquatic Weed Control

16.4 Resources for Aquatic Management

In addition to the LARE Program, there are many other sources of potential funding to help improve the quality of Indiana Lakes. Many government agencies assist in projects designed to improve environmental quality.

The USDA has many programs to assist environmental improvement. More information on the following programs can be found at www.usda.gov.

> Watershed Protection and Flood Prevention Program (USDA
>
> Conservation Reserve Program (USDA)
>
> Wetlands Reserve Program (USDA)
>
> Grassland Reserve Program (USDA)
>
> Wildlife Habitat Incentive Program (USDA)
>
> Small Watershed Rehabilitation Program (USDA)

The following programs are offered by the U.S. Fish and Wildlife Service. More information about the Fish and Wildlife service can be found at www.fws.gov

> Partners for Fish and Wildlife Program (U.S. Fish and Wildlife Service)
>
> Bring Back the Natives Program (U.S. Fish and Wildlife Service)
>
> Native Plant Conservation Program (U.S. Fish and Wildlife Service)

The Environmental Protection Agency, the Indiana Department of Environmental Management, and the U.S. Forest Service also have numerous programs for funding. A few of these are listed below. More information can be found at www.in.gov/idem and www.fs.fed.us/

U.S. Environmental Protection Agency Environmental Education Program (EPA)

NPDES Related State Program Grants (IDEM)

Community Forestry Grant Program (U.S. Forest Service)

16.5 State Regulations for Aquatic Plant Management

The following information is found on the IDNR website and outlines general regulations for the management of aquatic plants in public waters.

AQUATIC PLANT CONTROL PERMIT REGULATIONS
Indiana Department of Natural Resources

Note: In addition to a permit from IDNR, public water supplies cannot be treated without prior written approval from the IDEM Drinking Water Section. **Amended state statute adds biological and mechanical control (use of weed harvesters) to the permit requirements, reduces the area allowed for treatment without a permit to 625 sq ft, and updates the reference to IDEM.** *These changes become effective on July 1, 2002.*

Chapter 9. Regulation of Fishing
IC 14-22-9-10
   Sec. 10. (a) This section does not apply to the following:
      (1) A privately owned lake, farm pond, or public or private drainage ditch.
      (2) A landowner or tenant adjacent to public waters or boundary waters of the state, who chemically, mechanically, or physically controls aquatic vegetation in the immediate vicinity of a boat landing or bathing beach on or adjacent to the real property of the landowner or tenant if the following conditions exist:
         (A) The area where vegetation is to be controlled does not exceed:
            (i) twenty-five (25) feet along the legally established, average, or normal shoreline;
            (ii) a water depth of six (6) feet; and
      (iii) a total surface area of six hundred twenty-five (625) square feet.
         (B) Control of vegetation does not occur in a public waterway of the state.
   (b) A person may not chemically, mechanically, physically, or biologically control aquatic vegetation in the public waters or boundary waters of the state without a permit issued by the department. All procedures to control aquatic vegetation under this section shall be conducted in accordance with rules adopted by the department under IC 4-22-2.
   (c) Upon receipt of an application for a permit to control aquatic vegetation and the payment of a fee of five dollars ($5), the department may issue a permit to the applicant. However, if the aquatic vegetation proposed to be controlled is present in a public water supply, the department may not, without prior written approval from the department of environmental management, approve a permit for control of the aquatic vegetation.
   (d) This section does not do any of the following:
      (1) Act as a bar to a suit or cause of action by a person or governmental agency.
      (2) Relieve the permittee from liability, rules, restrictions, or permits that may be required of the permittee by any other governmental agency.
      (3) Affect water pollution control laws (as defined in IC 13-11-2-261) and the rules adopted under water pollution control laws (as defined in IC 13-11-2-261).
As added by P.L.1-1995, SEC.15. Amended by P.L.1-1996, SEC.64.

312 IAC 9-10-3 Aquatic vegetation control permits
Authority: IC 14-22-2-6; IC 14-22-9-10
Affected: IC 14-22-9-10
Sec. 3. (a) Except as provided under IC 14-22-9-10(a), a person shall obtain a permit under this section before applying a substance to waters of this state to seek aquatic vegetation control.
(b) An application for an aquatic vegetation control permit shall be made on a departmental form and must include the following information:
(1) The common name of the plants to be controlled.
(2) The acreage to be treated.
(3) The maximum depth of the water where plants are to be treated.
(4) The name and amount of the chemical to be used.
(c) A permit issued under this section is limited to the terms of the application and to conditions imposed on the permit by the department.

(d) Five (5) days before the application of a substance permitted under this section, the permit holder must post clearly, visible signs at the treatment area indicating the substance that will be applied and what precautions should be taken.

(e) A permit issued under this section is void if the waters to be treated are supplied to the public by a private company or governmental agency. *(Natural Resources Commission; 312*

16.6 Public Questionnaire

Lake Use Survey (15 total)   Lake name __Shipshewana__

Are you a lake property owner?   Yes _15_   No _0_

Are you currently a member of your lake association?   Yes _14_ No _1_

How many years have you been at the lake?   2 or less – 1
        2 – 5 years – 3
        5-10 years – 4
        Over 10 years – 7

How do you use the lake (mark all that apply)
    _5_ Swimming   _0_ Irrigation
    _13_ Boating   _0_ Drinking water
    _15_ Fishing   _0_ Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes _3_ No _9_

Do you currently participate in a weed control project on the lake? Yes _9_ No _2_

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes _9_ No _5_

Does the level of vegetation in the lake affect your property values? Yes _13_ No _2_

Are you in favor of continuing efforts to control vegetation on the lake? Yes _14_ No _0_

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes _13_ No _1_

Mark any of these you think are problems on your lake:
    _0_ Too many boats access the lake
    _0_ Use of jet skis on the lake
    _0_ Too much fishing
    _0_ Fish population problem
    _4_ Dredging needed
    _0_ Overuse by nonresidents
    _6_ Too many aquatic plants
    _0_ Not enough aquatic plants
    _6_ Poor water quality
    _2_ Pier/funneling problem

Please add any comments:

Deeper lake = less problem; bad errosion on channel shoreline reducing property line edge – what can be done to fill tot back in to prevent further erosion; weed control has helped; 1st season of lake with aquatic treatment appears successfull 2006 efforts in July = codastrophic end up with large biomass on southside; we're pleased with weed control this year – hopefully will continue. Need more weed banks + aquatic plants control (lilly pads + cattails).

Aquatic Weed Control

16.7 Species Distribution Maps

Figure 11: 2007 Tier II Sample Locations

Shipshewana Lake Sample Locations   May 3, 2007

Data use subject to license.
© 2004 DeLorme. XMap® 4.5.
www.delorme.com

MN (4.9° W)

Data Zoom 14-6
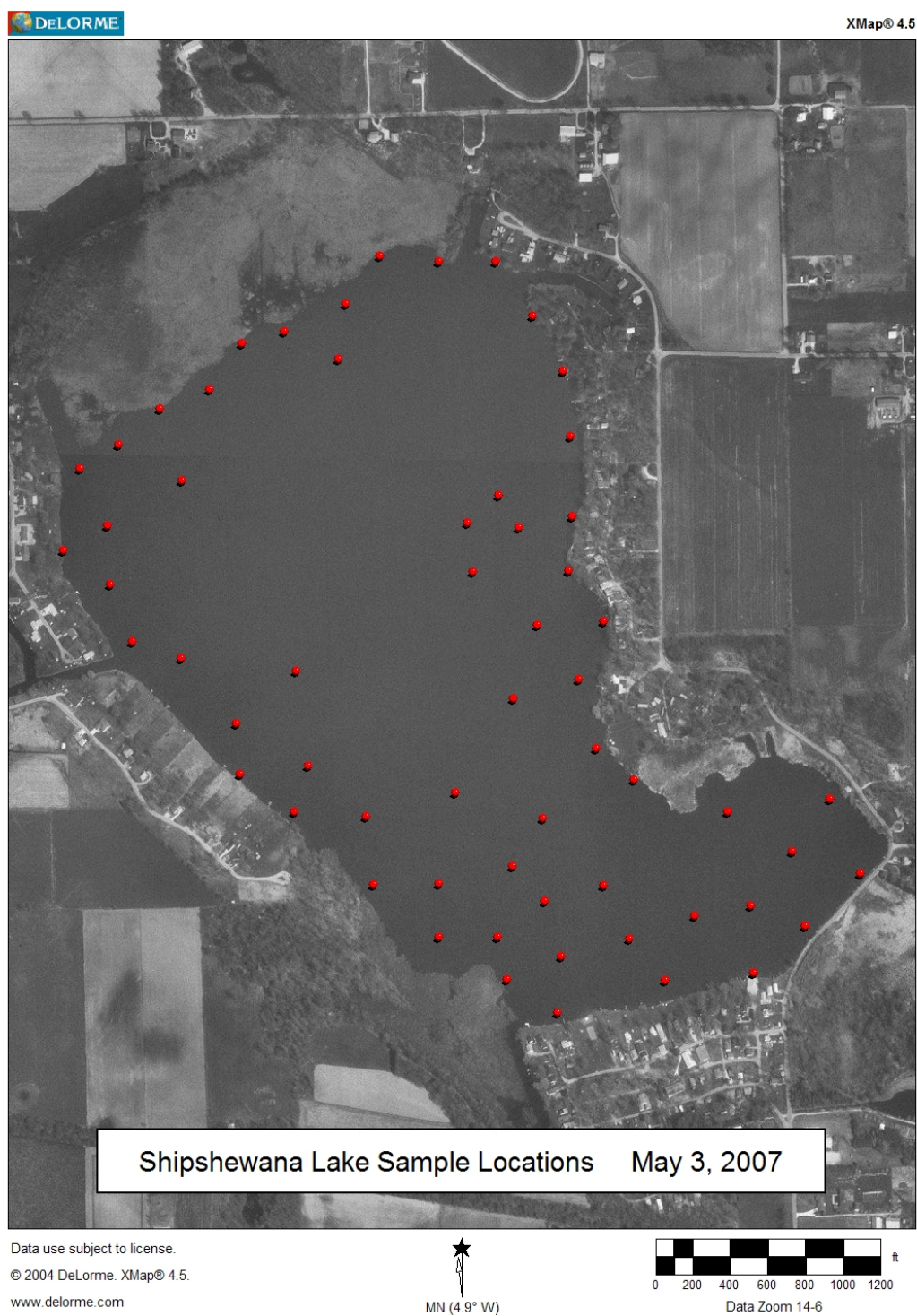
Figure 12: May 2007 Eurasian Watermilfoil Locations

Shipshewana Lake Eurasian Watermilfoil Locations   May 3, 2007

Figure 13: May 2007 Coontail Locations

Shipshewana Lake Coontail Locations   May 3, 2007

Figure 14: May 2007 Curly Leaf Pondweed Locations

Shipshewana Lake Curly Leaf Pondweed Locations   May 3, 2007

Figure 15: May 2007 Elodea Locations

Shipshewana Lake American Elodea Locations   May 3, 2007

Figure 16: May 2007 Sago Pondweed Locations

Shipshewana Lake Sago Pondweed Locations   May 3, 2007
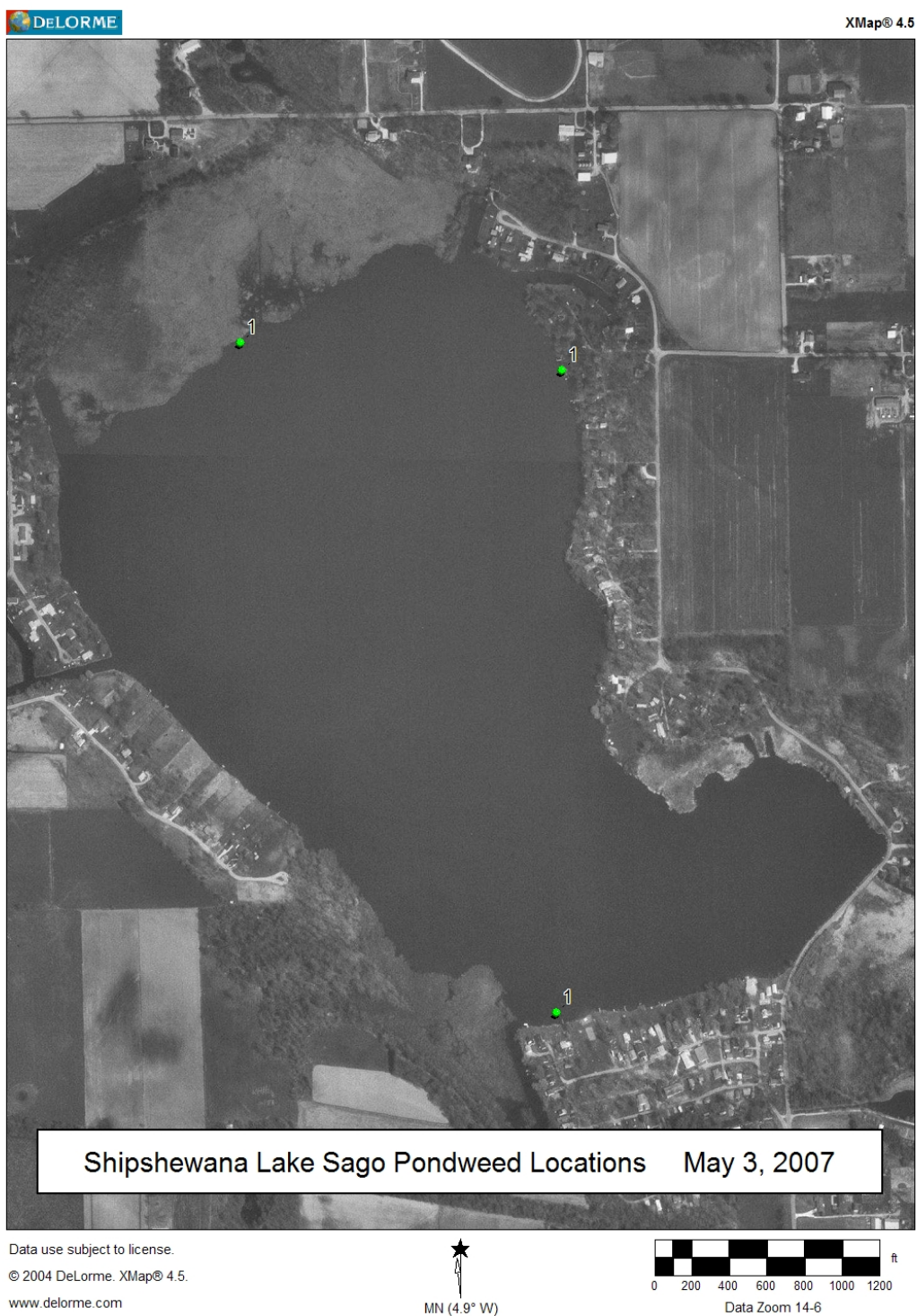
August 2007

Figure 17: August 2007 Sago Pondweed Locations

Shipshewana Lake Sago Pondweed Locations   August 17, 2007

Figure 18: August 2007 Coontail Locations

Shipshewana Lake Coontail Locations   August 17, 2007
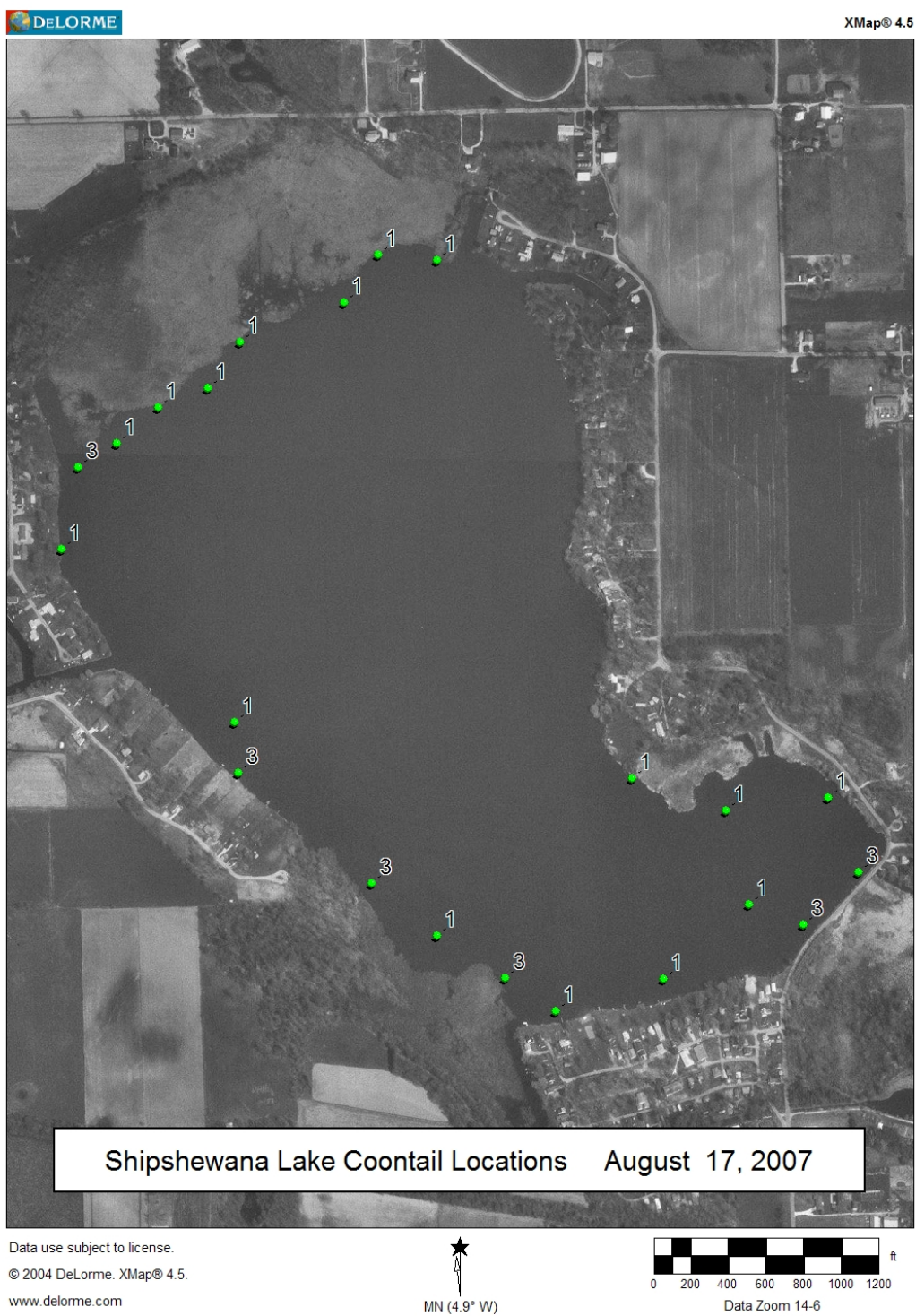
16.8 Data Sheets

Aquatic Vegetation Random Sampling

Waterbody Cover Sheet

Organization Name: Shipshewan Community Lake Improvement Association

Waterbody Name: Shipshewana Lake   Lake ID:

County: Lagrange County   Date: May 3, 2007

Habitat Stratum: IL   Ave. Lake Depth (ft): 7   Lake Level: Aug

GPS Metadata

Crew Leader: Dave Keister

NAD83	16	30ft
Datum:	Zone:	Accuracy:

Recorder: Dave Keister   Method: WAAS Enabled GPS

Secchi Depth (ft): 2.5   Total # of Sites Surveyed: 60   Total # of Species: 5

Littoral Zone Size (acres): 75
☐ Measured
☒ Estimated

Littoral Zone Max. Depth (ft): 6
☐ Measured
☐ Estimate (historical Secchi)
☒ Estimated (current Secchi)

Notable Conditions:
Secchi depth was measured at 2.5 ft
Water Temperature 64°
Planktonic Algae already starting

Aquatic Weed Control

APPENDIX A

Submersed Aquatic Plant Survey Form

WATER BODY NAME Shipshewana Lake		SECCHI 2.5								
COUNTY Lagrange		MAX PLANT DEPTH ~6ft								
DATE May 3, 2007		WEATHER Sunny, Breezy 60°								
CREW LEADER Dave		COMMENTS Water Temp 64° Some Planktonic Algae Alread								
RECORDER Dave										

Rake score (1, 3, 5), observed only (9), algae present (p)

Use acronyms for species, V1, V2...for voucher codes — Note

Species Code

Site	Latitude	Longitude	Depth	All	CEDE4	MYSP2	POPE6					Algae
1	GPS	Points	2	1	1							p
2			3	4	4	1						p
3			4	5	5							
4			4	5	5							
5	↓	↓	3	4	4							p.
6			2	4	4							p
7			3	3	1	3						p
8			4	1	1							
9			3	2		2						
10			4	1	1	1						
11			3	2	2	1						p
12			7	0								
13			5	0								
14			4	2		1	1					p
15			2	3	2	2						p
16			2	2	1	1						p
17			3	2	2							
18			4	2	2							
19			4	2	2							
20			6	0								
21			4	3	3							
22			2	2	2	1						p
23			5	2	2							
24			3	2	2							p.
25			7	0								
26			5	4	3	2						
27			4	4	4							
28			5	2	2							p
29			5	3	3							p
30			4	3	3							p
31			4	2	1	1						p
32			5	1	1							

Other plant species observed at lake

APPENDIX A

Submersed Aquatic Plant Survey Form

WATER BODY NAME Shipshewana Lake		SECCHI 2.5			
COUNTY Lagrange		MAX PLANT DEPTH ~6 ft			
DATE May 3, 2007		WEATHER Sunny, Breezy 60°			
CREW LEADER Dave		COMMENTS Water Temp 64°			
RECORDER Dave					

Rake score (1, 3, 5), observed only (9), algae present (p)
Use acronyms for species, V1, V2…for voucher codes

Site	Latitude	Longitude	Depth	All	CEDE4	MXSP2	PoPE6	PoPR3	V1				Algae
33	GPS Points		7	0									
34			4	2	2								P
35			4	4	3	2							
36			5	3	1	2							P
37			4	3	3								
38			5	0									
39			8	0									
40			5	4	4								
41			5	1	1								
42			5	2	2								
43			5	2	2	1							
44			5	0									
45			6	1	1								
46			5	2	2								
47			3	4	4								P
48			5	4	4								
49			3	5	4		1						P
50			4 5	5	5			1					
51			5	2	2								
52			4	4	4				V1				
53			4	2	2								
54			6	0									
55			5	1	1								
56			7	0									
57			8	0									
58			5	0									
59			9	0									
60			5	0									
Other plant species observed at lake													

Tier II Rake Sample GPS Coordinates

Site	Latitude	Longitude
1	41.68165	-85.601
2	41.68233	-85.6
3	41.6831	-85.5989
4	41.68419	-85.5995
5	41.684	-85.6015
6	41.68447	-85.6033
7	41.68493	-85.6041
8	41.68594	-85.6044
9	41.68679	-85.6039
10	41.68753	-85.6046
11	41.68831	-85.6045
12	41.68862	-85.606
13	41.68949	-85.6045
14	41.69044	-85.6047
15	41.69124	-85.6053
16	41.69203	-85.606
17	41.69204	-85.6071
18	41.69212	-85.6083
19	41.69142	-85.6089
20	41.69061	-85.6091
21	41.69101	-85.6101
22	41.69084	-85.611
23	41.69017	-85.6116
24	41.68989	-85.6126
25	41.68884	-85.6121
26	41.68937	-85.6134
27	41.68901	-85.6141
28	41.68818	-85.6136
29	41.68782	-85.6145
30	41.68731	-85.6135
31	41.68649	-85.6131
32	41.68625	-85.6122
33	41.68606	-85.6099
34	41.6853	-85.6111
35	41.68456	-85.611
36	41.68468	-85.6097
37	41.68401	-85.6099
38	41.68394	-85.6085
39	41.68428	-85.6068
40	41.68294	-85.6084
41	41.68295	-85.6071
42	41.68218	-85.6071
43	41.68218	-85.606
44	41.68321	-85.6057
45	41.68391	-85.6051
46	41.6827	-85.605
47	41.68156	-85.6058
48	41.68189	-85.6047
49	41.68107	-85.6048
50	41.68293	-85.6039
51	41.68215	-85.6034
52	41.68154	-85.6027
53	41.68248	-85.6021
54	41.68264	-85.601
55	41.68342	-85.6002

```
56   41.68566   -85.6057
57   41.68673   -85.6052
58   41.68751   -85.6064
59   41.68822   -85.6066
60   41.68816   -85.6056
```

16.9 IDNR Aquatic Vegetation Control Permit

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT
State Form 26727 (R / 11-03)
Approved State Board of Accounts 1987

Check type of permit
☐ Whole Lake ☒ Multiple Treatment Areas

INSTRUCTIONS: *Please print or type information*

FOR OFFICE USE ONLY	
License No.	
Date Issued	
Lake County	

Return to: Page **1** of ___
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: $5.00

Applicant's Name	Lake Assoc. Name	
Aquatic Weed Control	Professional Weed Control Company	
Rural Route or Street P. O. Box 325		**Phone Number** 574-533-2597
City and State Syracuse IN		**ZIP Code** 46567
Certified Applicator (if applicable) Jim Donahoe	**Company or Inc. Name** Above	**Certification Number** F-19215
Rural Route or Street P. O. Box 325		**Phone Number** 574-533-2597
City and State Syracuse IN		**ZIP Code** 46567

Lake (One application per lake)	Nearest Town	County
Shipshewana	Shipshewana	Lagrange

Does water flow into a water supply   ☐ Yes   ☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area #	1	LAT/LONG or UTM's N41degrees 40.872 W85 degrees 36.292

Total acres to be controlled	0.22	Proposed shoreline treatment length (ft)	100	Perpendicular distance from shoreline (ft)	100
Maximum Depth of Treatment (ft)	5	Expected date(s) of treatment(s) Mid June			

Treatment method: ☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Reward, Aquathat K, Copper sulfate, 2-4D, Renovate, Nautique

Plant survey method: ☐ Rake ☒ Visual ☐ Other (specify) _____

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian Milfoil	X	40
Curley Leaf	X	20
Algae	X	10
coontail	X	30

Page ____ of ____

Treatment Area #		LAT/LONG or UTM's		
Total acres to be controlled	Proposed shoreline treatment length (ft)		Perpendicular distance from shoreline (ft)	
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s)			

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking

rate for biological control.   Reward, Aquathal K, Copper sulfate, 2-4D, renovate, Nautique

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify) _____

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
	3/4/2006
Certified Applicant's Signature	Date
	3/4/2006

FOR OFFICE ONLY	
☐ Approved ☐ Disapproved	Fisheries Staff Specialist
☐ Approved ☐ Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

Aquatic
Weed
Control

DeLorme

W 1000 N

W 375 N   W 375 N   W 375 N

W 360 N

1

W 360 N

W 900 N

Wolfe Field

W 350 N   W 350 N

N 1000 W

W 335 N

N 960 W

W 325 N

N 920 W

N 916 W

Shipshewana Lake

N 982 W

Beatys Beach

N 900 W

W 1000 N

W 270 N

W 280 N

N 920 W

PARKVIEW ST

N 910 W

N 905 W

W 270 N

N 915 W

Mother Ditch

United Brethren Camp

N 900 W

W 260 N

W 250 N   W 250 N   W 250 N

W 1000 N

N 925 W

MN (4.9° W)

0   500   1000   1500   ft

Data Zoom 14-1

Aquatic
Weed
Control